

PAPER MONEY RECEIVING AND PAYING APPARATUS
AND AUTOMATIC TELLER MACHINE

Background of the Invention

The present invention relates to a paper money receiving and paying apparatus and an automatic teller machine for receiving and/or paying paper
5 moneys.

An automatic teller machine which has been used in a financial institution is adapted to receive and pay paper moneys.

It is necessary to take various paper moneys
10 having different sizes into consideration, as those to be handled in the automatic teller machine. JP-A-2000-187752 discloses a means for stacking and separating paper moneys having different sizes. This means can stack and separate paper moneys by manually adjusting
15 the height of a top plate in accordance with a length of the narrow side of a paper money even though paper moneys to be handled have different sizes. That is, after the position of the top plate is manually adjusted, only paper moneys having a certain size can
20 be stacked and separated.

By the way, when paper moneys are loaded in an automatic teller machine, all denominations of paper moneys to be loaded are led through a paper money determining part from a loading and recovering bin in
25 which the paper moneys have been packed, so as to

determine denominations and numbers of paper moneys which are then conveyed to and loaded in return bins for respectively storing the denominations of paper moneys.

5 Further, in order to recover paper moneys in the automatic teller machine, paper moneys are conveyed from the return bins and through the paper money determining part so as to determine denominations and number of paper moneys. The paper moneys of different
10 denominations are then conveyed to and stored into the loading and recovering bin. Further, in order to precisely check a number of paper moneys in the automatic teller machine, the recovering and loading are successively repeated.

15 In the above-mentioned handling, it is required to accumulate and separate paper moneys of different denominations which are mixed together in the loading and recovering bin. However, the device disclosed in the JP-A-2000-187752 cannot cope with
20 storage of paper moneys having different sizes in a mixed condition, that is, the conventional automatic teller machine cannot load, recover and precisely check paper moneys having different sizes.

Brief Summary of the Invention

25 An object of the present invention is to provide a paper money receiving and paying apparatus and an automatic teller machine which includes a device

for stacking and separating paper moneys having different sizes in a mixed condition.

The above-mentioned object can be achieved by a configuration comprising a stacking and separating
5 device for stacking and separating paper moneys, a size detecting means for detecting sizes of paper moneys stacked in the stacking and separating device, a travel regulating means for regulating a travel of a paper money in the accumulating and separating device, and a
10 control part for controlling the travel regulating means in accordance with sizes of the paper moneys.

Further, the above-mentioned object can be achieved by such a configuration that the travel regulating means causes the leading end of a paper
15 money to impinge thereupon, and the position of the travel regulating means is changed depending upon a size of a paper money.

Further, the above-mentioned object can be achieved by such a configuration that the travel
20 regulating means is rotated so as to change the position where the leading end of a paper money impinge thereupon, depending upon a size of a paper money.

Further, the above-mentioned object can be achieved by such a configuration that a part or all of
25 the external shape of the travel regulating means is arcuated.

Further, the above-mentioned object can be achieved by an interference preventing means for

preventing a paper money having stacked from entering into a space where paper moneys are stacked.

Further, the above-mentioned object can be achieved by such a configuration that the stacking and
5 separating device incorporates a storage space for storing paper moneys, and the interference preventing means is an inclined floor surface in the storage space.

Further, the above-mentioned object can be
10 achieved by such a configuration that the stacking and separating device comprises a push-plate for supporting paper moneys having been stacked, and the interference preventing means is the push-plate defining an inclined surface during stacking of paper moneys.

15 Further, the above-mentioned object can be achieved by such a configuration that the travel regulating means and the interference preventing means are integrally incorporated with each other.

Further, the above-mentioned object can be
20 achieved by such a configuration that the travel regulating means and the interference preventing means can be retracted so as to prevent interference with stacked paper moneys.

Further, the above-mentioned object can be
25 achieved by such a configuration that either or both of the travel regulating means and the interference preventing means incorporate a friction reducing member for reducing friction with respect to a paper money.

Further, the above-mentioned object can be achieved by such a configuration that there are provided a plurality of travel regulating means and/or interference preventing means.

5 Further, the above-mentioned object can be achieved by such a configuration that the travel regulating means incorporates a paper money entrance preventing means for preventing a paper money from being caught after stacking.

10 Further, the above-mentioned object can be achieved by such a configuration that the paper money stacking and separating device incorporates a separating and stacking guide for guiding introduced and stacked paper moneys, the separating and stacking
15 guide having one end part which has a curved surface.

Further, the above-mentioned object can be achieved by such a configuration that the paper money size detecting means incorporates a paper money determining means for determining a denomination of a
20 paper money, and a memory part having a data base in which denominations and sizes of paper moneys are related to one another.

Further, the above-mentioned object incorporates a paper money detecting means for
25 detecting a paper money to be conveyed to the stacking and separating device, and the travel regulating means is controlled through detection of a paper money by the paper money detecting means.

Further, the above-mentioned object can be achieved by such a configuration that there is provided a stacking space volume detecting means for detecting an occupied space by paper moneys after stacking, which
5 occupy a space for stacking therein paper moneys within the stacking and separating device, and the travel regulating means is controlled in accordance with a result of detection by the stacking space volume detecting means.

10 Further, the above-mentioned object can be achieved by such a configuration that the stacking and separating device stacks paper moneys in a standing posture.

Further, the above-mentioned object can be
15 achieved by the paper money receiving and paying apparatus comprising a receiving and paying port for carrying out either or both of separation of paper moneys introduced by a user, and stacking of paper moneys to be paid for a user, a paper money determining
20 part for determining a denomination of a paper money, a temporary storage bin for temporarily storing paper moneys, either or both of a receiving bin for storing paper moneys which are inappropriate for payment and return bins for storing therein and discharging
25 denominations of paper moneys, respectively, and a conveying path connecting the paper money determining part, the temporary storage bin and the above-mentioned bins, for conveying paper moneys, characterized in that

the above-mentioned stacking and separating device is the temporary storage bin.

The above-mentioned object can be achieved by the paper money receiving and paying apparatus

5 comprising a receiving and paying port for carrying out either or both of separation of paper moneys introduced by a user, or stacking of paper moneys to be paid for a user, a paper money determining part for determining a denomination of a paper money, a temporary storage bin

10 for temporarily storing paper moneys, return bins for storing therein and discharging denominations of paper moneys, respectively, a charge and recovery bin for recovering paper and loading moneys from and into the return bins, and a conveying path connecting the paper

15 money determining part, the temporary storage bin and the above-mentioned bins, for conveying paper moneys, characterized in that the above-mentioned stacking and separating device is either or both of the temporary storage bin and the charge and recovery bin.

20 Further, the above-mentioned object can be achieved by an automatic teller machine incorporating the above-mentioned paper money receiving and paying apparatus.

The present invention will be detailed in the

25 form of preferred embodiments of the invention with reference to the accompanying drawings in which:

Brief Description of the Several views of the Drawing

Fig. 1 is a perspective view illustrating an external appearance of an automatic teller machine to which the present invention is applied;

Fig. 2 is a block diagram illustrating a
5 control mechanism in the automatic teller machine to which the present invention is applied;

Fig. 3 is an elevation view illustrating a configuration of a paper money receiving and paying apparatus;

10 Fig. 4 is a block diagram illustrating a control mechanism in the paper money receiving and paying apparatus in an embodiment of the present invention;

Fig. 5 is an elevation view for explaining
15 operation of loading of paper moneys in the embodiment of the present invention;

Fig. 6 is a flow-chart for loading paper moneys in the embodiment of the present invention:

Fig. 7 is an elevation view for explaining
20 operation of recovery of paper moneys in the embodiment of the present invention;

Fig. 8 is a flow chart for recovery of paper moneys in the embodiment of the present invention;

Fig. 9 is a side view for explaining a
25 condition in which paper moneys are stored into a loading and recovering bin;

Fig. 10 is a side view for explaining a condition in which paper moneys are discharged from the

loading and recovering bin;

Fig. 11 is a top view illustrating the loading and recovering bin installed in the paper money receiving and paying apparatus;

5 Fig. 12 is a side view illustrating a configuration of a travel regulating means;

Fig. 13 is a view for explaining operation of storing paper moneys in the loading and recovering bin;

10 Fig. 14 is a block diagram illustrating a control mechanism for storing and discharging paper moneys into and from the loading and recovering bin;

Fig. 15 is a flow-chart for controlling the travel regulating means during stacking of paper moneys;

15 Fig. 16 is a flow chart for controlling the travel regulating means during stacking of paper moneys;

Fig. 17 is a side view illustrating another example of an interference preventing means;

20 Fig. 18 is a side view illustrating another example of the interference preventing means;

Fig. 19 is a top view illustrating another friction reducing member;

25 Fig. 20 is a plan view illustrating a configuration of a stacking assist means;

Fig. 21 is a side view for explaining storing of paper moneys into the loading and recovering bin

Fig. 22 is a side view for explaining

discharging of paper moneys from the loading and
recovering bin;

Fig. 23 is a top view illustrating the
loading and recovering bin installed in the paper money
5 receiving and paying apparatus;

Fig. 24 is a view for explaining operation of
storing of paper moneys into the loading and recovering
bin;

Fig. 25 is a view for explaining operation of
10 storing of paper moneys into the loading and recovering
bin;

Fig. 26 is a block diagram illustrating a
control mechanism for storing and discharging paper
moneys into and from the loading and recovering bin;

15 Figs. 27A to 27D are views for explaining
operation of storing of paper moneys into the loading
and recovering bin;

Fig. 28 is a flow-chart for controlling the
stacking assist means during stacking of paper moneys;

20 Fig. 29 is a view for explaining operation of
storing paper moneys into the loading and recovering
bin; and

Fig. 30 is a view illustrating another
example of the loading and recovering bin.

25 Detailed Description of the Invention

Referring to Fig. 1 which is a view
illustrating an external appearance of an automatic

teller machine in which the present invention is applied, the automatic teller machine 101 in this embodiment, comprises, a card/check processing mechanism 102 for processing a traction card or a traction check owned by the customer, a banknote processing part 105 for processing a banknote, a housing 104, and a customer manipulation part 105 for displaying or inputting data required for traction. A paper money receiving and paying apparatus 1 is incorporated in the housing 104.

Fig. 2 is a block diagram illustrating a control scheme of the present invention.

Referring to Fig. 2, the card/check processing mechanism 102, the bank note processing mechanism 103, the customer manipulation part 105 and the paper money receiving and paying apparatus 1 are connected to the main control part 106 through the intermediary of a bus 110 so that they carry out required operation under the control of the main control part 106. In addition to the above, there are provided an interface part 107, an operator manipulation part 108 and an external memory device 109 which are also connected to the bus 110, for transmitting data therebetween. However, detailed description thereto will be omitted. Further, the above-mentioned mechanisms and components are powered by a power source part 111.

Fig. 3 is a view illustrating the

configuration of the paper money receiving and paying apparatus mounted in the automatic teller machine 101.

Fig. 4 is a view illustrating a control mechanism.

5 Referring to Figs. 3 and 4, the paper money receiving and paying apparatus 1 comprises a receiving and paying port 2 for receiving and paying paper moneys, a paper money determining part 3 for determining a denomination of a paper money, or
10 determining whether a paper money is true or false, a temporary storage part 4 for temporarily storing received paper moneys until a transaction is completed, paper money bins for storing paper moneys, and a conveying path 5 connecting components in the paper
15 money receiving and paying device 1 to one another, for conveying paper moneys.

The paper money bins are sorted in view of their roles, into for example, a receiving bin for storing therein paper moneys which are no more used as
20 paper moneys to be paid, return bins for respectively storing denominations of paper moneys, and discharging them upon payment, a loading and recovering bin for loading paper moneys into the return bins, and recovering paper moneys from the return bins.

25 In this embodiment, a receiving bin 6 is incorporated in a lower right part of the apparatus as shown in Fig. 3. Further, the remainder of the paper money bins is used as return bins 7. For example, they

are for 50 Euro-dollar, 100 Euro-dollar and 200 Euro-dollar in the mentioned order as viewed from the left side of the figure. Further, the loading and recovering bin 8 is located in the middle stage of the apparatus. The loading and recovering bin 8 is adapted to store thereinto and discharge therefrom paper moneys to be handed in the paper money receiving and paying apparatus, in a mixed condition so as to be load or recover paper moneys into and from the return bins.

Further, the paper money receiving and paying apparatus 1 incorporates a memory part DB in which correspondence between denominations and sizes of paper moneys is recorded. Thus, a size of a paper money can be found by determining a denomination thereof. The control part 9 is connected to the main control part 106 through the intermediary of the bus 110 so as to control the paper money receiving and paying apparatus 1 in accordance with an instruction from the main control part 106 and a detected state of the paper money receiving and paying apparatus 1, and the state of the paper money receiving and paying apparatus 1 is transmitted to the main control part 106 as required.

The loading of paper moneys can be carried out when the apparatus is replenished with paper moneys, for example, in the case of loading of paper moneys into the apparatus before operation of the automatic teller machine 101, and in the case of loading of paper moneys when the number of loaded paper

moneys becomes less during operation.

Fig. 5 is a view illustrating the configuration of the automatic teller machine, for explaining the loading operation of paper moneys in the
5 embodiment of the present invention.

Referring to Fig. 5, upon loading of paper moneys, paper moneys in the loading and recovering bin 8 are fed onto the conveying path 5, and are conveyed in the direction of the arrow in the figure. At this
10 stage, denominations and a number and conditions of paper moneys are determined by means of the paper money determining part 3, and paper moneys which are not for payment are stored in the receiving bin 6, and paper moneys which are for payment are stored in the
15 returning bins 7, being sorted into respective denomination groups.

Fig. 6 is a flow-chart for the above-mentioned loading of the paper moneys.

Meanwhile, the recovery of paper moneys are
20 carried out as required, in the case of recovery of paper moneys in the automatic teller machine 101 after the operation is closed, or upon requirement of recovery of paper moneys in the apparatus when the number of loaded paper moneys becomes excessive during
25 the operation.

Fig. 7 is a view illustrating a configuration of an automatic teller machine for explaining the operation during recovery of paper moneys in this

embodiment.

Referring to Fig. 7, during recovery of paper moneys, paper moneys in the return bins 7 are fed onto the conveying path 5, and are conveyed in the direction of the arrow. At this time, denominations and numbers of paper moneys are determined by way of the paper money determining part 3, and then the paper moneys are stored in the loading and recovering bin 8. It is noted that, in this embodiment, the receiving bin 6 is adapted to be directly removed in order to recover paper moneys therein.

Fig. 8 shows a flow-chart for the recovery operation.

The number of paper moneys in the apparatus can be confirmed by carrying out the recovery operation and the loading operation.

Fig. 9 is a side view illustrating a state in which paper moneys are stored in the loading and recovering bin 8.

Fig. 10 is a side view illustrating a state in which paper moneys are discharged from the loading and recovering bin 8.

Fig. 11 is a top view illustrating the configuration of the loading and recovering bin 8 mounted in the paper money receiving and paying apparatus 1.

Referring to Figs. 9, 10 and 11, the loading and recovering bin 8 is a horizontal paper money bin in

which paper moneys are horizontally stored in a standing posture, and is adapted to store and separate paper moneys having different sizes.

A paper money introducing and discharging
5 mechanism is composed of stack feed rollers 801, pick-up rollers 811, driven backup rollers 802 and gate rollers 803 which are rotated in a storing direction but is not rotated in a pay-out direction, and brush rollers 804 which are coaxial with the gate rollers 803
10 and to which flexible push-in members are radially arranged, and a separating and stacking guide 805 whose position is changed between separation and stacking.

The stack feed rollers 801 are driven for rotation with the use of a drive source and gears which
15 are not shown, so as to feed paper moneys to be stored, and feed paper moneys to be discharged onto the conveying path 5. The backup rollers 802 are rotated being driven by the stack feed rollers 801 so as to pinch a paper money between itself and the stack feed
20 roller 801 in order to convey the paper money. The gate roller 803 are rotated being driven by the stack feed rollers 80 when paper moneys are stored but is not rotated when they are discharged.

That is, when paper moneys are separated and
25 paid out by the pick-up rollers 811 and the stack-feed rollers 801, a paper money adjacent to a paper money to be discharged makes contacts with the gate rollers 803 in order to prevent the paper money from being paid out

following the paper money to be discharged.

The stack feed rollers 801 and the gate rollers 803 define an introduction and discharge port communicated with the stacking space. That is, after
5 the paper money introduced from the outside is released from the pinch between the stack feed rollers 801 and the gate rollers 803, it falls in a unrestrained condition, and is therefore introduced into the stacking space.

10 It is noted the brush rotor 804 has the flexible push-in members only for a substantially semicircular circumference thereof in order to carry out discharge operation of paper moneys. When paper moneys are stored, it is rotated in the storing
15 direction of paper moneys, the paper moneys stacked in the stacking space are scraped into the storage space by the flexible push-in members which are radially arranged. When the paper moneys are discharged, the brush rollers 804 come to a stop at a position at which
20 no flexible push-in members appear in the stacking space. Thus, paper moneys can be discharged without interference with the flexible push-in members.

Further, the pick-up rollers 811 are driven in synchronization with the stack-feed rollers 801, and
25 further, the brush rollers 804 are adapted to be rotated, reverse to the rotation of the stack feed roller 801 so as to aim at commonly using the drive source.

It is noted that the brush rollers 804 is coupled to the stack feed rollers 801 through the intermediary of a one-way clutch, and accordingly, the brush rollers 804 are not rotated upon discharge of
5 paper moneys.

Further, the one-way clutch is the one which is rotated in one direction but is not in a reverse direction, that is, it is rotated clockwise, but is not counterclockwise.

10 The separating and stacking guide 805 has a surface on the stacking space side, which serves as a paper money guide surface for guiding a paper money when it is stored or discharged. Upon storing of a paper money, the paper money guide surface is located
15 at a position which is along an extension from the introduction and discharge opening of the introducing and discharging mechanism in the traveling direction of paper moneys. Upon discharging of paper moneys, the paper money guide surface is retraced up to a position
20 where the pickup rollers 811 are exposed.

The storage space is defined being surrounded by the floor surface 808, a floor surface belt 807 which is suspended so as to support the lower ends of paper moneys at a surface above the floor surface 808,
25 the push-plate 806, the separating and stacking guide 805, the top plate 810 and side walls 913.

The side walls 913 are mounted at positions which can be set in accordance with a size of a paper

money. The width between the side walls 813 is appropriately set, being adjusted to a value which is larger than a widthwise dimension of a paper money by 2 to 10 mm. Further, the distance between the floor surface 808 and the top plate 810 is set to a value which is larger than the heightwise length of a paper money having a largest size. Thus, paper moneys having a largest size to be handled in the paper money receiving and paying apparatus can be stored.

10 A transmission sensor is composed of a light emitting element 888a and a light receiving element 888b. When a paper money is present in the vicinity of the introduction and discharge opening, the paper money blocks a light beam so that the presence of the paper money in the vicinity of the introduction and discharge opening can be known.

Four Blade Mechanism

 In this embodiment, the travel regulating means 891 for restraining an excessive travel of a paper money to be stacked is provided above the separating and stacking guide 805.

 Fig. 12 is a view illustrating a configuration of the travel regulating means 891.

 Referring to Fig. 12, the travel regulating means 891 incorporates, at each distal end thereof, a rolling member 891a as a friction reducing member for reducing friction with respect to a paper money.

 It is noted that there may be used, as

another example of the friction reducing member, a spherical or rhombus part at the distal end of the travel regulating means 891, or a spherical or rhombus movable element, as shown in Fig. 19, instead of the rolling member 891a.

The stacking space is defined by the separating and stacking guide 805, the floor surface 808 and the travel regulating means 891, and paper moneys introduced from the outside are stacked in this stacking space.

It is noted, as shown in Fig. 9, that the floor surface belt 807 and the floor surface 808 are inclined so as to serve as the interference preventing means, and accordingly, the side walls 813, a rail for the push plate 806 and the top plate 810 are inclined. Thus, paper moneys are prevented from being caught to the separating and stacking guide 805, thereby it is possible to ensure the stacking space.

It is noted that the loading and recovering bin 8 may be installed, being inclined in its entirety in the paper money receiving and paying apparatus 1 as another means for attaining the above-mentioned object.

The travel regulating means 891 has a role of restraining a paper money from excessively traveling upward when it is stacked in the stacking space.

It is noted, as shown in Fig. 11, a plurality of travel regulating means 891 are provided widthwise of a paper money so that the upper ends of the stacked

paper moneys are regulated at a plurality of positions.

Further, in order to prevent a paper money from entering thereabove, being accompanied with the rotation of the travel regulating means 891, as shown
5 in Fig. 9, a paper money entrance preventing means having a shape for catching a paper money may be provided above the stacking space.

Operation of Four Blades

Next, explanation will be made of the
10 operation in such a case that paper moneys having different sizes are stored, being mixed together, in the loading and recovering bin 8.

Fig. 14 is a schematic view which shows control of storing and discharging of paper moneys into
15 and from the loading and discharging bin.

Referring to Fig. 14, the control part 9 runs under control drive parts and sensors and the like in the loading and recovering bin 8. Further, a paper money size detecting means composed of the paper money
20 determining part 3 for determining a denomination of a paper money, and the memory part DB having the data base for correspondence between denominations and sizes of paper moneys, recognizes a size of a paper money passing through the paper money determining part 3, and
25 delivers at once data thereof to the control part. At this stage, data corresponding to an order number on conveyance thereof is also transmitted to the control part 9.

Fig. 13 is a view for explaining the operation for storing paper moneys into the loading and recovering bin in this embodiment.

Referring to Fig. 13, a paper money is passed
5 through the paper money determining part 3, and
thereafter, it is conveyed to the loading and
recovering bin 8. The control part 9 drives a motor
801m for the stack feed rollers so as to rotate the
stack feed roller 801 and the gate roller 803, and
10 accordingly, the paper money 1000 is pinched
therebetween so as to be conveyed into the loading and
recovering bin 8. At this time, the paper money 1000
is conveyed, being maintained in its standing posture
along the paper money guide surface of the separating
15 and stacking guide 805.

Further, after it is released from the
pinching between the stack feed rollers 801 and the
gate rollers 803, the leading end of the paper money
1000 impinges upon a projection (the rolling member
20 891a) of the travel regulating means 891.

It is noted that the control part 9 drives a
motor 891 for the travel regulating means in accordance
with a paper money conveying time from the paper money
determining part 3 to the loading and separating bin 8
25 when data concerning a paper money to be introduced
into the loading and recovering bin 8 is delivered to
the control part 9, and accordingly, the travel
regulating means 891 is rotated counterclockwise under

control as viewed in Fig. 13 so that the distance from the floor surface 808 to the protrusion of the travel regulating means 891 becomes equal to a length of any of paper moneys to be stacked, in the traveling
5 direction.

It is noted that the travel regulating means 891 is controlled so as to be rotated, in principle, by a portion of one protrusion for one paper money. Thus, the leading end of the paper money 1000 is regulated in
10 order to prevent excessive travel thereof, and accordingly, paper money can be stacked with their leading ends are aligned with one another on the floor surface 808.

Further, the protrusions of the travel
15 regulating means 891 are rotated one by one for every paper money, and accordingly, paper moneys having different sizes can be successively stacked.

It is noted as shown in Fig. 13 that a paper money detecting means 892 for detecting a paper money
20 on running may be arranged in the vicinity of the back-up roller 802 so as to rotate, under control, the travel regulating means 891 for every paper money to be stacked with a timing of passing of the paper money.

Fig. 15 is a view which shows a control flow-
25 chart for storage operation of the travel regulating means 891 in this embodiment.

Fig. 16 is a view which shows a control flow chart for storage operation of the travel regulating

means 891 in this case.

It is noted that the lower ends of paper moneys stacked in the stacking space are restrained by the brush rollers 804 so as to prevent a next paper money from impinging upon them. Meanwhile when a number of paper moneys in the vicinity of the stacking space is increased so that a time by which the transmission sensor 888 is shielded is longer than a predetermined time, the control part 9 drives the drive motor 806m for the push-plate so as to displace the push-plate 806 in a direction in which the storage space is enlarged.

Separating Operation of Four Blades

Next, explanation will be made of operation in the case of discharging paper moneys from the loading and recovering bin 8. When paper moneys are discharged from the loading and recovering bin 8, as shown in Fig. 10, the drive motor 806m for the push-plate is driven so as to displace the push-plates 809 toward the separating and stacking guide 805 so as to press stored paper moneys against the separating and stacking guide 805. Simultaneously, the separating and stacking guide 805 and the travel regulating means 891 are retracted so as to expose the pick-up rollers 811. Further, by rotating the pick-up rollers 811, stored paper moneys are separated one by one while they are discharged outside from the loading and recovering bin 8.

It is noted that stable discharge of paper moneys can be made since the lower ends of paper moneys are stacked being aligned with one another along the floor surface 808 upon stacking of paper moneys, as
5 mentioned above.

Thus, according to the present invention, paper moneys having different sizes can be stored in one and the same loading and recovering bin, being mixed with one another.

10 Fig. 17 is a view for illustrating the interference preventing means in another embodiment.

Fig. 18 is a view for illustrating the interference preventing means in the other embodiment.

Referring to Figs. 17 and 18, although it has
15 been explained that the floor surface belt 807 and the floor surface 808 are inclined so as to serve as the interference preventing means, a push-plate 806a incorporating a push-plate inclining spring 806s may be used as the interference preventing means. In this
20 case, as shown in Fig. 17, the push-plate 806a is inclined by a force of the push-plate inclining spring 806s so as to incline the stored paper moneys in the storage space, and accordingly, the stored paper moneys are prevented from being caught by the separating and
25 stacking guide 805, thereby it is possible to ensure the stacking space. Meanwhile, as shown in Fig. 18, as the push-plate 806a is displaced toward the separating and stacking guide 805 during separation of paper

moneys, the postures of the stored paper moneys and the push-plate 806a are changed in a direction along the separating and stacking guide 805, due to a reaction force of the separating and stacking guide 805, and
5 accordingly, stable separation can be carried out.

Fig. 19 is a view for explaining the friction reducing means in another embodiment.

Single Blade Mechanism

It is noted that a stacking assist means 812
10 having both functions of the travel regulating means and the interference preventing means may be used as shown in Fig. 20 which will be hereinbelow explained, instead of the travel regulating means 891 shown in Fig. 12. The stacking assist means 812 is composed of
15 a stopper part 812a capable of executing the function of the travel regulating means and a paper money supporting part 812b capable of executing the function of the interference preventing means.

The stopper part 612a has a role of
20 regulating an upward travel of a paper money when paper moneys are stacked in the stacking space. The paper money supporting part 812b defines a boundary between the stacking space and the storage space, and has a role of supporting the paper moneys stored in the
25 storage space. The distance between the distal end of the paper money supporting part 512b to the floor surface 808 is shorter than the length of a paper money having a smallest size in the traveling direction,

which is to be handled in the paper money receiving and paying apparatus 1, that is, it is shorter than the height of the paper money which is stored in its standing posture. With this configuration, a paper money introduced in its standing posture is prevented from turning over, and as well, paper moneys having stored in the storage space from entering into the stacking space.

Although the stacking assist means shown in Fig. 20 has only one paper support part 812b, it may have two paper money support parts 812b.

It is noted that paper moneys are not held between one of the paper money supporting members 812b and the other one of them, but the paper moneys are stacked in the stacking space defined by the paper support parts 812b, the stopper part 612a, the separating and stacking guide 805 and the floor surface 808.

Fig. 23 is a top view illustrating the configuration of the loading and recovering bin 8 incorporating the stacking assist means 812. Further, Fig. 21 is a side view which shows such a state that paper moneys are stored in the loading and recovering bin 8 while Fig. 22 is a side view which shows such a state that paper moneys are discharged from the loading and recovering bin 8.

It is noted, as shown in Fig. 24, that the separating and stacking guide 805 incorporates a

stacking space volume detecting means 890 which is normally projected into the stacking space by a spring which is not shown, but which is turned down toward the separating and stacking guide 805 by paper moneys when
5 the paper moneys occupies the stacking space. Thus, occupation of the stacking space by paper moneys can be detected.

Stacking Operation of Single Blade

Next, explanation will be made of the
10 operation of the loading and recovering bin 8 in the case of storing paper moneys. In the case of the storing paper money in the loading and recovering bin 8, recovery or precisely investigation of paper moneys are carried out. That is, paper moneys are successively
15 conveyed to the loading and recovering bin 8 for each of the return bins 7 for respectively storing different denominations of paper moneys, in other words, paper moneys having one and the same size are conveyed in a bundle to the associated loading and recovering bin 8.

20 As shown in Fig. 26, the control part 9 runs drive parts, sensors and like in the loading and recovering bin 8. Further, the paper money size detecting means which is composed of the paper money determining part 3 for determining a denomination of a
25 paper money, and the memory part DB having a data base in which denominations and sizes of paper money are related to one another recognizes a size of a paper money passing through the paper money determining part

3, and transmits data thereof to the control part 9.

When the data of a size of a paper money to be introduced into the loading and recovering bin 8 is transmitted to the control part 9, the control part 9
5 drives a drive motor 812m for the stacking assist means 812 which is therefore rotated up to a position where the distance from the floor surface 808 to the stopper part 812a becomes equal to the length of the paper money to be introduced in the traveling direction, and
10 is then fixed. It is noted that Fig. 24 shows such a state that the size of a paper money to be introduced is relatively small, and Fig. 25 shows such a state that the size of a paper money to be introduced is relatively large. Further, it is noted, as shown in
15 Fig. 29, that the upper part of the separating and stacking guide 805 may be formed in a circular shape so as to increase the upper limit of the size of paper moneys which are allowed to be stacked.

Next, the drive motor 801m for the stack feed
20 rollers is driven so as to rotate the stack feed rollers 801 and the gate rollers 503 in order to clamp and convey a paper money 1000 into the loading and recovering bin 8. At this time, the paper money 1000 is conveyed being held in its standing posture along
25 the separating and stacking guide 805.

Further, when the clamp between the stack feed rollers and the gate rollers 803 is released, the leading end of the paper money 1000 impinges upon the

stopper part 812 of the stacking assist means 812.
That is, by regulating the leading end of the paper
money 1000, excessive traveling is prevented, and
accordingly, paper moneys can be stacked with their
5 trailing ends aligned along the floor surface 808.

When stacking of paper moneys as mentioned
above is continued so that the degree of occupation of
the stacking space by the stacked paper moneys becomes
larger, which is detected by the stacking space volume
10 detecting means 890, as shown in Fig. 27, the control
part 9 drives the drive motor 812m for the stacking
assist means 812 which is therefore rotated. Thus, a
paper moneys existing between the separating and
stacking guide 805 and the paper money supporting part
15 812b are shifted into the storage space, and
accordingly, no paper moneys are present in the
stacking space. It is noted that the conveyance of the
paper moneys to the loading and recovering bin 8 is
desirably interrupted when the stacking assist means
20 812 is being rotated.

After the storage of paper moneys having a
certain size has been completed through the above-
mentioned procedure, the position of the stacking
assist means 812 is changed in accordance with a size
25 of paper moneys to be then stored, the storage thereof
is carried out. With the repetitions of these steps,
paper moneys stored in the return bins 7 can be stored
in the single loading and recovering bin 8 by a number

which is as large as that allowed by the capacity thereof. Fig. 28 shows a control flow-chart for the storage operation of the stacking assist means 812 in this embodiment.

5 It is noted the configurations of the brush rollers 804 and the push plate 806, and the control thereof are the same as those stated above. However, the driving timing of the push-plate 806 may be synchronized with the rotating timing of the above-
10 mentioned stacking assist means 512.

Separating Operation of Single Blade

Next, explanation will be made of the operation in the case of discharging paper moneys from the loading and recovering bin 8. When paper moneys
15 are discharged from the loading and recovering bin 8, as shown in Fig. 22, the drive motor 806m for the push-plate is driven so as to displace the push-plate 805 toward the separating and stacking guide 805 in order to press stored paper moneys against the separating and
20 stacking guide 805. Simultaneously, the separating and stacking guide 805 and the stacking assist means 812 are retracted from the storage space so as to expose the pick-up rollers 811 which are then rotated so as to discharge stored paper moneys, being separated one by
25 one, outside of the loading and recovering bin 8. It is noted that the paper moneys can be stably discharged since the paper moneys are stored with their lower ends are aligned along the floor surface 808 during stacking

thereof, as stated above.

With the use of the loading and recovering bin 8 stated above, it is possible to provide an automatic teller machine capable of loading and
5 recovering paper moneys having different sizes into the paper money receiving and paying apparatus.

It is noted that the temporary storage part 4 for temporarily storing received paper moneys until the transaction thereof is completed, is the one which
10 stacks, at first, paper moneys introduced in the receiving and paying port 2 by a user, and accordingly, it has a function of stacking paper moneys having different sizes, similar to the loading and recovering bin 8. Thus, with the application of the present
15 invention to the temporary storage part 4, it is possible to provide an automatic teller machine which can receive and pay paper moneys having different sizes.

Further, in this embodiment, although
20 explanation has been made of such an example that the receiving bin is used for receiving reject paper moneys, and the return bins are used to receive different denominations of paper moneys, respectively, the loading and recovering bin 8 in this embodiment may
25 be used as the receiving bin or the return bin.

Further, although explanation has been made of the paper money bin of a horizontal type in which paper moneys are stored in a standing posture, the

present invention can be applied to a paper money bin of a vertical type in which paper moneys are horizontally stacked, as shown in Fig. 30. It is noted as shown in Fig. 30 that a push-plate 806b may be
5 inclines so as to align the left ends of paper moneys along the floor surface 808 side under the gravitation. In this case, although the direction of inclination of the push-plate 806b is different from that of the push-plate 806a as stated above, the function thereof is the
10 same as that of the latter.

The other components shown in Fig. 30 have functions similar to those as stated above. Thus, even in the loading and recovering bin 8 of a horizontal type, the stacking of paper moneys which are aligned
15 along the floor surface 808 can be made with the provision of the travel regulating means 891 for restraining excessive travel, thereby it is also possible to stably separate paper moneys.

Further, the apparatus according to the
20 present invention can be applied not only to paper moneys but also to all paper sheets.

With the use of the present invention, there can be provided a paper money receiving and paying apparatus and an automatic teller machine which can
25 stack and separate paper moneys having different sizes in a mixed condition.

It should be further understood by those skilled in the art that although the foregoing

description has been made on embodiments of the invention, the invention is not limited thereto and various changes and modifications may be made without departing from the spirit of the invention and the
5 scope of the appended claims.